

30 November 1967

Materiel Test Procedure 8-2-193  
Deseret Test Center

U. S. ARMY TEST AND EVALUATION COMMAND  
COMMODITY ENGINEERING TEST PROCEDURE

COLLECTIVE PROTECTION SYSTEMS, FIELD SHELTERS

1. OBJECTIVE

The objective of this materiel test procedure (MTP) is to determine the technical performance and safety aspects of the test item relative to the criteria cited in applicable Qualitative Materiel Requirements (QMR's), Small Development Requirements (SDR's), Technical Characteristics (TC's), and other requirements and documentation that pertain to a particular test item.

2. BACKGROUND

Collective protection systems for field shelters are required to provide personnel in the field with protection against the ingress of chemical and biological agents into shelters used for essential field operations, rest or relief.

Collective protection systems are adaptable for use with general purpose tentage, field medical facilities, and other shelters such as command posts, communications centers, and other portable pressurized shelters.

It is necessary to test the technical performance of collective protection systems and determine their safety aspects to ensure that they meet applicable specifications and standards.

3. REQUIRED EQUIPMENT

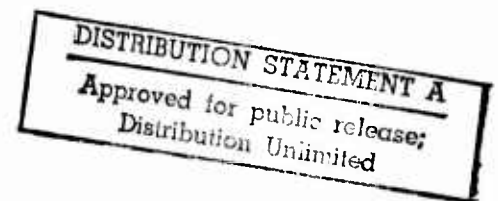
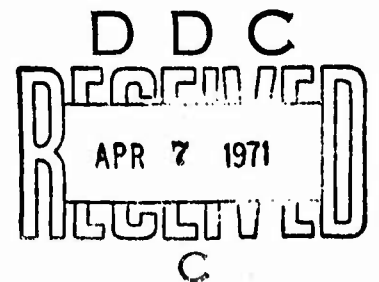
- a. Materials Handling Equipment
- b. Maintenance Tools
- c. Environmental Test Facilities including:

- 1) Shock and vibration
- 2) Extreme temperatures
- 3) Temperature/humidity
- 4) Altitude
- 5) Sunshine
- 6) Salt fog
- 7) Water immersion
- 8) Rain
- 9) Snow
- 10) Dust
- 11) Fungus

- d. Field Test Facilities, including:

- 1) Snow-making equipment
- 2) Fog-oil smoke producing equipment

- e. Instrumentation for Continuous Measurement and Recording of:



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- 1) Temperature
- 2) Pressure
- 3) Air flow rates
- 4) Voltage
- 5) Current
- 6) Time
- 7) Relative humidity

f. Meteorological Equipment for the Measurement of:

- 1) Ambient air temperature
- 2) Barometric pressure
- 3) Wind velocity
- 4) Wind direction
- 5) Relative humidity

g. Chemical Agents and Simulants as required

h. Chemical Agent Detectors and Samplers

i. Chemical Agent Alarms

j. Chemical Agent Disseminating Devices

k. Pigeons

l. Biological Agents and Simulants as required

m. Biological Agent Detectors and Samplers

n. Biological Agent Alarms

o. Biological Agent Disseminating Devices

p. Laboratory Facilities, for analyses

q. Photographic Equipment, still and motion picture, color and black and white

r. Sound Level Indicator

s. Decontamination Equipment

t. Dioctyl Phthalate (DOP) Penetrometer

u. Puncture-Repairing Tape

v. Wind-Producing Equipment

w. Protective Clothing and Equipment

4.

REFERENCES

- A. Technical Memorandum 93, The Need for Biological Decontamination of Field Shelters, Occupants, and Methods of Control, U. S. Army Biological Center, June 1966, AD 486 316.
- B. Technical Information Report 21-4-1B1, Development of Collective Protection for Tentage and Field Shelters, University of Pittsburgh Army Materiel Research Staff, April 1964.
- C. MIL-STD-810B, Environmental Test Methods, 15 June 1967.
- D. MIL-STD-282, Filter Units, Protective Clothing, Gas Mask Components and Related Products, Performance Test Methods, 28 May 1956
- E. AMC Pamphlet 706-134, Engineering Design Handbook Maintainability Guide for Design, August 1967.
- F. Second Bimonthly Progress Report on Collective Protection for Combat Field Structures, prepared for U. S. Army Edgewood Arsenal by Aerospace Research, 1 Sept - 31 Oct 1963, AD 425 914.

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- G. Woodson, W. E., and Conover, D. W., Human Engineering Guide for Equipment Designers, Second Edition, U. of California Press, Los Angeles, California, 1966.
- H. American Society for Testing Materials (ASTM) Standards as follows:
  - 1) D-1230-61 - Flammability of Clothing Textiles.
  - 2) D-751-66T - Methods of Testing Coated Fabrics (Tentative).
- I. USATECOM Regulation 385-6, Safety Release.
- J. Chemical Medical Laboratories Research Report No. 62, Micro Determination of Chloropicrin.
- K. MTP 8-2-500, Receipt Inspection.
- L. MTP 8-2-503, Rough Handling and Surface Transport.
- M. MTP 7-1-002, Air Portability and Air Drop Service Testing.
- N. MTP 7-2-509, Air Drop Capability of Materiel.
- O. MTP 8-2-066, Alarms, Biological.
- P. MTP 8-2-191, Alarms, Chemical.
- Q. MTP 8-2-510, Decontamination.

## 5. SCOPE

### 5.1 SUMMARY

The procedures outlined in this MTP provide general methods for determining the technical characteristics and performance of the test item. Specific testing requirements and procedures will be dictated by the performance and characteristics criteria for a particular test item.

The following subtests shall be performed on a selective basis, as required, to determine if the test item meets the criteria established:

- a. Receipt Inspection - An inspection of the test item as received to: (1) Determine its physical characteristics and condition; (2) Locate any defects that it might have; and (3) Identify damage received during transport.
- b. Safety Evaluation - A procedure to: (1) Ensure that adequate safety features have been incorporated into the test item, (2) Check the Safety Statement issued by the developing agency; (3) Determine the noise level of the operating item; and (4) Obtain data to be included in the Safety Release Recommendation required by USATECOM Regulation 385-6.
- c. Performance Test - An operational test of the test item to evaluate its performance before and after being subjected to the various conditions of the included subtests.
- d. Flammability Test - A study to determine the capacity for combustion of the material used for the air-lock and shelter liner.
- e. Physical Strength Tests - A study to determine such properties as tensile strength, tensile stress, ultimate elongation, set and tear resistance of the material used for the air-lock and shelter liner.
- f. Agent Penetration Tests - A study to determine the chemical agent resistance of the material used for the air-lock and shelter liner.
- g. Simulated Environmental Testing - A study to determine the effects of extreme temperature, fungus, humidity, sunshine, salt fog, altitude, water immersion, rain, snow, and dust on the performance of the test item.
- h. Field Test - A study to determine the technical performance

characteristics of the test item in wind and fog-oil smoke at ambient temperatures.

i. Rough Handling and Surface Transportability - A study to determine the effects of rough handling and surface transport on the physical and operational characteristics of the test item.

j. Air Transportability - A study to determine the effects of air transport conditions on the physical and operational characteristics of the test item.

k. Air Drop Capability - A study to determine the effects on the test item resulting from its being subjected to air drop conditions.

l. Chemical Challenge Tests - A study to determine: (1) Whether the test item can provide and maintain filtered air under positive pressure at a level which precludes the infiltration of hazardous levels of chemical agents; (2) The degree of contamination associated with personnel entry and exit while under simulated chemical agent attack; and (3) The time required to purge the interior of the sheltered area of chemical contamination.

m. Biological Challenge Tests - A study to determine: (1) The degree of protection afforded personnel from viable biological particulate aerosols; (2) The degree of contamination associated with personnel exit and entry while under simulated biological attack; and (3) The time required to purge the interior of the sheltered area of biological contamination.

n. Emergency Adaptability - A study to determine the capability of the test item pressure system to maintain satisfactory internal pressures when the air tight liner has been punctured by small arms fire and whether time is available for the occupants to take emergency protective measures during CBR attacks.

o. Alarm Tests - Studies to determine the effectiveness of chemical or biological alarms if these units are among the test item components.

p. Decontamination Aspects - A study to determine the related ease or difficulty involved in decontamination of the test item and the effects of decontamination on the test item.

q. Gas Life Test - A study to determine the protective life of the gas filter(s).

r. Special "Gas" Tests - Studies to determine the performance reliability of the gas-particulate filters using DOP and PS agents.

s. Maintenance Aspects - A study to determine the technical characteristics of the test item relative to design for maintainability provisions, aspects, and instructions.

t. Human Factors - An evaluation of the characteristics of the test item that involve human factors considerations in the handling and operation of the test item.

## 5.2 LIMITATIONS

None

## 6. PROCEDURES

### 6.1 PREPARATION FOR TEST

#### 6.1.1 Safety Statement

a. Test and subtest plans and procedures shall ensure performance in the safest manner consistent with accomplishing the mission. The cardinal principal is to limit exposure of a minimum of personnel, for a minimum time, to a minimum amount of hazardous material consistent with safe and efficient operations. Plans shall include safety procedures, precautions, protections, and emergency procedures as necessary. Technical information on the hazards and safety characteristics of the test item as provided by the Safety State-ment and other pertinent information shall be included. Such information shall include evaluation of potential hazards, analysis of risks, limitations, and precautions including special test equipment and techniques that should be incorporated in test plans and procedures.

b. A specific individual shall be charged with responsibility for safety. He shall be familiar with the construction and operation of the test item and its critical components, shall have full knowledge of the hazards and safety aspects of the test, and shall review test procedures for evaluation of hazards and recommend control measures.

c. All personnel who participate in or observe the tests shall be briefed on the hazards involved and proper test methods and procedures.

#### 6.1.3 Security

Security considerations shall be adequately determined and provided for as applicable for each subtest.

#### 6.1.4 Logistical Requirements

Prior to the conduct of the test, the test officer shall ensure that all logistical requirements are satisfied.

#### 6.1.5 Instrumentation Requirements

In order to evaluate the performance characteristics of the test item during its operation under the conditions specified in the various subtests, instrumentation capable of measuring and continuously recording the following parameters, shall be installed in each test item, prior to testing, at locations specified in the test plan:

a. Temperatures, as follows:

- 1) Shelter unit, ambient interior
- 2) Air-lock, ambient interior
- 3) Ambient exterior

b. Pressures, as follows:

- 1) Shelter unit interior
- 2) Air lock interior
- 3) Ambient exterior

c. Input voltage to the gas-particulate filter unit.

d. Input current to the gas-particulate filter unit.

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- e. Air output (flow-rate) of the gas-particulate filter unit.
- f. Relative humidity of the shelter unit interior

6.2 TEST CONDUCT

6.2.1 Receipt Inspection

The test item shall be subjected to the applicable procedures of MTP 8-2-500, following its arrival at the test site with emphasis on the following:

a. Adequacy of packaging - Visually inspect the test item packaging and record the following:

- 1) Binding deficiencies such as broken straps, seals, etc.
- 2) Packaging material deficiencies such as cuts, tears, breaks, etc.

b. Test item inspection:

- 1) Visually inspect the test item for damages such as dents, cracks, illegible markings, etc.
- 2) Survey the test item to determine if it has been contaminated by:
  - a) Liquid contaminant
  - b) Solid contaminant

c. Determine the weight, length, width, and height of individual major components, packaged and unpackaged.

d. Serialize and identify each major component for future identification.

e. Photograph the major components.

6.2.2 Safety Evaluation

a. Throughout the conduct of this MTP, hazardous features shall be specifically observed and noted.

b. Verify the test item safety aspects included in the Safety Statement issued by the developer.

c. Determine the acoustical noise level at the octave band limits prescribed in HEL-STD-S-1-63B at the positions prescribed.

d. The data to be included in the Safety Release Recommendation, required by USATECOM Regulation 385-6, shall be obtained.

6.2.3 Performance Test

a. Erect and pressurize the test item and install instrumentation as specified in paragraph 6.1.5.

b. Operate the test item for the length of time specified in the test plan to check the system against performance requirements.

NOTE: During this check-out, the heating-cooling apparatus, the recirculated-air purification system, and the new-air purification system shall be operated. These units make up the environmental control system (ECS).

c. Determine and record the following for each test item:

- 1) Duration of test item operation
- 2) Malfunctions (if any)
- 3) Cause(s) of malfunctions
- 4) Duration of ECS operation
- 5) ECS malfunctions, if any
- 6) Cause(s) of ECS malfunctions

d. Retain all continuously recorded data.

#### 6.2.4 Flammability Test

- a. Subject sample specimens of the material(s) used in the shelter liner and air-lock liner to the flammability tests as prescribed by ASTM-D-1230-61.
- b. Compare the results of the flammability tests of these materials to those of "standard", similar materials.
- c. Record the test material nomenclature.

#### 6.2.5 Physical Strength Tests

- a. Subject sample specimens of the material(s) referred to in paragraph 6.2.4 to the mechanical tests specified in ASTM-D-751-66T.
- b. Record the following for each test conducted:
  - 1) Test identity
  - 2) Test material nomenclature
  - 3) Test specimen sizes (if "non-standard")

NOTE: Test sample preparations shall be recorded if die-cut samples are used in tear-resistance tests.

#### 6.2.6 Agent Penetration Tests

- a. Subject sample specimens of the material(s) referred to in paragraph 6.2.4 to liquid agent resistance tests using the following agents:
  - 1) GF
  - 2) VX
  - 3) Distilled mustard (HD)
- b. Determine and record the test specimen resistances to the agents according to test methods devised by the cognizant laboratory at U. S. Army Edgewood Arsenal, Edgewood, Maryland.



NOTE: Appendix A describes a test method for agent penetration.

c. Record the following for each test conducted:

- 1) Test material nomenclature
- 2) Test specimen dimensions
- 3) Ambient temperature of the test room
- 4) Relative humidity of the test room
- 5) Agent identity
- 6) Test method
- 7) Data required by the test method selected

#### 6.2.7 Simulated Environmental Testing

##### 6.2.7.1 Extreme Temperature Tests

Unless otherwise directed, the test item, after having successfully passed the performance test of paragraph 6.2.3, shall be subject to the following temperature tests:

- a. Install a minimum of four test items in a temperature chamber and operate the test items as described by the procedures of paragraph 6.2.3.
- b. Reduce the chamber temperature to -80°F (-62.2°C) and maintain the temperature level for 72 hours.
- c. Inspect the test items and record any damages.
- d. Raise the chamber temperature to -65°F (-53.9°C) or to its minimum operating temperature and maintain this temperature until stabilization is achieved for a 24-hour period, and perform the following:

NOTE: Stabilization, unless otherwise specified, is considered to be attained when the temperature of the test item does not vary more than 3.6°F (2°C) per hour.

- 1) Inspect the test items and record any damages.
- 2) Remove 1/2 of the test items and verify their operability as described by the procedures of paragraph 6.2.3.

e. Raise the chamber temperature to local ambient temperature level and verify the operability of the test items as described by the procedures of paragraph 6.2.3.

f. Record the test item identification numbers.

##### 6.2.7.1.2 High Temperature Tests - Perform the following:

- a. Install a minimum of four test items in a temperature chamber and operate the test items as described by the procedure of paragraph 6.2.3.
- b. Raise the chamber temperature to 155°F (88.3°C) with an absolute humidity of 13 grains of H<sub>2</sub>O/ft<sup>3</sup> of air and maintain these conditions for a minimum of four hours.
- c. Inspect the test items and record any damage.

d. Lower the chamber temperature to 120°F (48.9°C) with a relative humidity of less than 15% and maintain these conditions for a minimum of 24 hours, and perform the following:

- 1) Inspect the test items and record any damage.
- 2) Remove 1/2 of the test items and verify their operability as described by the procedures of paragraph 6.2.3.

e. Adjust the chamber temperature and humidity to local ambient levels and perform the following:

- 1) Inspect the test items and record any damage.
- 2) Verify the operability of the test items as described by the procedures of paragraph 6.2.3.

#### 6.2.7.2 Humidity Tests

a. Subject a minimum of four test items, which have successfully passed the performance test of paragraph 6.2.3, to the humidity cycling prescribed by reference 4C (MIL-STD-810), Method 507.

b. At the completion of the cycling period, perform the following:

- 1) Visually inspect the test items and record any signs of corrosion.
- 2) Disassemble 1/2 of the test items and inspect the components for corrosion and/or deterioration.
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.3.

#### 6.2.7.3 Fungus Test

a. Subject a minimum of four test items, which have successfully passed the performance test of paragraph 6.2.3, to the fungus exposure prescribed by reference 4C (MIL-STD-810), Method 508.

b. At the completion of the exposure period, perform the following:

- 1) Visually inspect 1/2 of the test items (if applicable, disassemble them) and record if any fungus was present on the test item components.
- 2) Verify the operability of the test items by subjecting the remaining items to the procedures of paragraph 6.2.3.

#### 6.2.7.4 Sunshine Test

a. Subject a minimum of four test items, which have successfully passed the performance test of paragraph 6.2.3, to the solar radiation exposure prescribed by reference 4C (MIL-STD-810), Method 505. The surface and interior temperature will be monitored by thermocouples.

b. At the completion of the exposure period, perform the following:

- 1) Visually inspect the test items and record any surface

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damages noted.

NOTE: Sunshine causes heating of equipment and fading of fabric colors, checking of paints, and deterioration of natural rubber and plastics.

- 2) Verify the operability of the test items by subjecting them to the procedures of paragraph 6.2.3.

#### 6.2.7.5 Salt Fog Test

a. Subject a minimum of four test items, which have successfully passed the performance test of paragraph 6.2.3, to the conditions prescribed by reference 4C (MIL-STD-810), Method 509.

b. At the completion of the salt fog spray exposure, perform the following:

- 1) Rinse the test item with clear water.
- 2) Visually inspect the test item for, and record the presence of, corrosion
- 3) If applicable, disassemble 1/2 of the test items and inspect the components for, and record:
  - a) Evidence of water penetration
  - b) Presence of corrosion
- 4) Verify the operability of the test item by subjecting the remaining test items to the procedures of paragraph 6.2.3.

#### 6.2.7.6 Altitude Tests

a. Subject a minimum of four test items, which have successfully passed the performance test of paragraph 6.2.3, to the conditions prescribed by reference 4C (MIL-STD-810), Method 500.

b. At the conclusion of the altitude testing, perform the following:

- 1) Inspect the test items and record any evidence of damage.
- 2) Disassemble 1/2 of the test items and inspect the components for damage.
- 3) Verify the operability of the test item by subjecting the remaining test items to the procedures of paragraph 6.2.3.

#### 6.2.7.7 Water Immersion Tests

a. Immerse a minimum of four test items, packed in their original containers, in water to a predetermined depth.

NOTE: The water depth and temperature, and duration of immersion shall be in accordance with applicable criteria and quality control system requirements as stipulated in the test directive.

b. Record the following with the test items immersed:

- 1) Depth of water over container
- 2) Temperature of water
- 3) Presence of bubbling to indicate container leakage
- 4) Immersion time until bubbling occurs
- 5) Total immersion time

c. At the completion of the immersion test, remove the test items from their containers and perform the following:

- 1) Visually inspect the test items for, and record the presence of, corrosion.
- 2) Disassemble 1/2 of the test items and inspect the components for, and record:
  - a) Evidence of water penetration
  - b) Presence of corrosion
- 3) Verify the operability of the test items by subjecting the remaining test items to the procedures of paragraph 6.2.3.

#### 6.2.7.8 Rain Test

a. Subject a minimum of four of the test items to a simulated rain test while the gas-particulate filter unit is in the process of pressurizing the test items with the air-lock erected and the gas-particulate filter unit in the sheltered position.

NOTE: The rain shall be produced by a spray nozzle of such design as to emit droplets having a minimum diameter of 1.5 mm. If possible, the spray shall be centered on the shelter and air-lock for a length of time and at a rate which have been pre-determined. The rain droplets shall contain a fluorescein dye to aid in later identification of water leaks.

b. Operate the test items as described in paragraph 6.2.3 with the gas-particulate unit in a sheltered position, while they are being subjected to the simulated rain.

c. Open the test items at the completion of the rainfall and inspect the air-locks and shelter units, visually, and with ultraviolet light.

d. Record evidence of water penetration of, and damage to:

- 1) Air-locks
- 2) Shelter units

e. Remove the gas-particulate filters and motor section and inspect each, visually, and with ultraviolet light for water penetration and damage.

f. Record evidence of water penetration of, and damage to:

- 1) Gas filter(s)

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- 2) Particulate filter(s)
- 3) Unit housing
- 4) Dust collector
- 5) Motor section

g. Determine the efficiency of the gas and particulate filters using the procedures of paragraph 6.2.18.

h. Subject the four test items to the rainfall test (steps a through g) with the gas-particulate filter unit in the unsheltered position.

#### 6.2.7.9 Snow Tests

- a. Erect and pressurize the test item air-lock and shelter unit.
- b. Install instrumentation as described in paragraph 6.1.5.
- c. Operate the test item as described in paragraph 6.2.3.
- d. Subject the test item to snow produced by an artificial snow

maker.

NOTE: The snow produced shall be of sufficient depth so as to produce a pressure on the air-lock and shelter unit as specified in the test plan.

e. Operate the test item under the snow load as described in paragraph 6.2.3.

f. Record the following during the full snow load:

- 1) Depth of snow on the air-lock and shelter unit.
- 2) Pressure of snow on the air-lock and shelter unit.
- 3) Any indications of damage.

NOTE: The ambient air temperature must be low enough to sustain the snow load during operations.

g. Remove the snow load and inspect and record evidence of damage to the test item air-lock, shelter unit and gas-particulate filter unit.

h. Subject the gas and particulate filters to the procedures of paragraph 6.2.18.

i. Photograph damaged test item sections and components.

j. Repeat steps d through i with the snow applied to the test item from another direction until the snow has been directed from at least four different directions.

k. Repeat steps a through j until a minimum of four test items have been subjected to the snow tests.

#### 6.2.7.10 Dust Removal Tests

a. Determine and record the weights of the test item gas and particulate filters to the nearest gram.

b. Erect and pressurize the test item air-lock and shelter unit.

c. Install instrumentation as described in paragraph 6.1.5.

d. Subject the test item to a dust test in a sand and dust chamber using the rate at which the dust is introduced, the dust concentration to be maintained and the duration of dust exposure as specified in the test plan.

NOTE: The criteria for the dust or silica flour used for this simulated environment is described in MIL-STD-810, Method 510.

e. Operate the test item during the dust exposure as described in paragraph 6.2.3.

f. Record the time at which the particulate filter warning light is energized.

g. At the completion of testing:

- 1) Determine and record the weights of the gas and particulate filters to the nearest gram
- 2) Inspect the dust collector and record any damage
- 3) Photograph dust collector damage

h. Repeat steps a through g until a minimum of four test items have been subject to the dust removal tests.

#### 6.2.8 Field Operations

Perform field operations at the prevailing ambient temperatures for the testing sites.

##### 6.2.8.1 Wind Challenge Tests

- a. Erect a minimum of four test item shelter units and air-locks.
- b. Install instrumentation as described in paragraph 6.1.5.
- c. Record the erection operations on motion picture film.
- d. Determine and record the time required to erect each test item.
- e. Strike a minimum of four test item shelter units and air-locks.
- f. Record the striking operations on motion picture film.
- g. Determine and record the time required to strike each test item.
- h. Subject a minimum of four test items, with shelter units and air-locks pressurized, to winds of the maximum velocity specified in the test plan.
- i. Verify the operability of the test item during the wind challenge according to the procedures of paragraph 6.2.3.
- j. Test personnel shall enter and leave the test item a minimum of six times during the wind challenge.
- k. Record entry and exit operations on motion picture film.
- l. Repeat the wind challenge steps h through k at least three times with the wind directed at various sides of the test item.
- m. Determine and record the following for each test item wind challenge:

- 1) Maximum wind velocity
- 2) Wind direction with respect to the test item

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- 3) Number of entries made
- 4) Number of exits made
- 5) Deleterious effects on the test item operability
- 6) Duration of the wind challenge.

n. Upon completion of the wind challenge testing, inspect the test items and record any evidence of damage.

o. Photograph test item damage.

#### 6.2.8.2 Fog-Oil Smoke Test

a. Erect a minimum of four test items with air-locks and shelter units pressurized.

b. Install instrumentation as described in paragraph 6.1.5.

c. Subject the test items to fog-oil smoke of a prescribed density and duration as specified in the test plan.

d. Operate the test item during the fog-oil smoke challenge as described in paragraph 6.2.3.

e. Determine and record the following for each test item:

- 1) Fog-oil smoke density
- 2) Duration of fog-oil smoke challenge
- 3) Wind direction
- 4) Wind speed
- 5) Deleterious effects of the fog-oil smoke on the test item operability
- 6) Evidence of damage to test item components.

f. Photograph test item damage.

#### 6.2.9 Rough Handling and Surface Transportability

a. Subject a minimum of four test items, in their original packages to the applicable reference 4C (MIL-STD-810) shock and vibration procedures described in MTP 8-2-503.

b. At the completion of testing, perform the following:

- 1) Visually examine the test item packages and record the presence of cracks, breaks, undone bindings, etc.
- 2) Visually examine the test items and record the presence of damage.
- 3) Photograph test item damage.
- 4) Verify the operability of the test items by subjecting them to the procedures of paragraph 6.2.3.

#### 6.2.10 Air Transportability

Determine the effects of pressure-altitude and vibration, similar to that which will be experienced by the test item in flight and the ease of loading/unloading aircraft as follows:

NOTE: Background information on air transportability is contained in MTP 7-1-002.

#### 6.2.10.1 Loading/Unloading

a. Load the test items, in their shipping containers, aboard aircraft or simulated aircraft facilities, as indicated in the test plan loading schedule, using normal loading equipment and record the following:

- 1) Type of aircraft used/simulated
- 2) Shipping container length, width, height, weight and material
- 3) Equipment used for loading
- 4) Difficulties encountered while loading
- 5) Method of tie-down
- 6) Damage incurred to the package while loading

b. Unload the test items from the aircraft/simulated aircraft and record the following:

- 1) Equipment used in unloading
- 2) Difficulties encountered while unloading

#### 6.2.10.2 Simulated Flight Tests

a. Subject a minimum of four test items (crated/packaged for shipment) to the following simulated conditions, simultaneously:

- 1) Ambient pressure equal to that of the maximum altitude that the test item is expected to be flown
- 2) Flight vibration conditions as described by the applicable sections of MIL-STD-810, Method 514

b. At the completion of altitude/vibration testing, repeat the procedures of paragraph 6.2.9 step b.

#### 6.2.11 Air Drop Capability

The air drop of the test item, when in its shipping container (crate/package) shall be determined as described in the applicable sections of MTP 7-2-509 and as follows:

a. Rig a minimum of four test items in the appropriate air drop containers and drop the containers from aircraft flying at the altitude and speed stipulated in the test plan. Record the following:

- 1) Aircraft used
- 2) Aircraft altitude
- 3) Aircraft air speed
- 4) Meteorological conditions
- 5) Air delivery system trajectory and impact velocities
- 6) Acceleration "G" force magnitude at impact



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b. Conduct visual coverage of the air drop test procedures with motion and still camera.

c. At the completion of the test, perform the following:

- 1) Visually examine the test item's package for, and record the presence of cracks, breaks, undone bindings, etc.
- 2) Visually examine the test items for, and record the presence of damages and/or deformations.
- 3) Verify the operability of the test items as described by the procedures of paragraph 6.2.3.

#### 6.2.12 Chemical Challenge Tests

##### 6.2.12.1 Preparation for Test

Perform the following:

- a. Select a building of suitable size in which to conduct the tests.
- b. Erect and pressurize the test item air-locks and shelter units.
- c. Install instrumentation as described in paragraph 6.1.5.
- d. Install the following at locations specified in the test plan:
  - 1) Selected chemical agent samplers
  - 2) Chemical agent alarms
  - 3) Pigeons
- e. Determine and record the amounts and rates of dissemination of the selected chemical agents required to produce the concentrations specified in the test plan for each test.
- f. Select the dissemination method for each chemical agent challenge. Position and prepare for operation the appropriate dissemination devices.
- g. Ensure that test personnel have an adequate supply of protective clothing and equipment available.

##### 6.2.12.2 Test Conduct

###### 6.2.12.2.1 Non-Entry-Exit Test - Perform the following:

- a. Subject a minimum of four test items to chemical challenge of Sarin (GB), or other suitable agent.
- b. Initiate sampling and operate the test items in the contaminated atmosphere, as described in paragraph 6.2.3, for the length of time specified in the test plan.
- c. At the completion of the exposure period:
  - 1) Open and ventilate the test building
  - 2) Open and ventilate the test items
  - 3) Decontaminate the equipment according to the applicable procedures of paragraph 6.2.16.
  - 4) Analyze and record the results from the sampling and detection devices.

- 5) Examine the pigeons for chemical agent symptoms and record the examination results.

6.2.12.2.2 Entry-Exit Test - Perform the following:

- a. Subject a minimum of four test items to a chemical agent challenge of methylacetoacetate (MAA), or other suitable agent.

NOTE: Chemical agent alarms and pigeons shall not be used during entry-exit tests.

- b. Initiate sampling and operate the test items in the contaminated atmosphere, as described in paragraph 6.2.3, for the length of time specified in the test plan.

- c. Test personnel (assisted by a CBR sentinel, if required) shall perform the following according to procedures specified and included in the test plan:

- 1) Decontamination of equipment
- 2) Removal of contaminated clothing
- 3) Entrance into the test item
- 4) Exit from the test item

- d. Record all entry and exit operations on color motion picture film. A minimum of six entries and exits should be made.

- e. At the completion of the contaminant exposure period:

- 1) Open and ventilate the test building.
- 2) Open and ventilate the test items.
- 3) Decontaminate the equipment according to the applicable procedures of paragraph 6.2.16.
- 4) Analyze and record the results from the sampling and detection devices.

6.2.12.2.3 Purge Trials - Perform the following:

- a. Subject the interiors of a minimum of four test items to a chemical agent challenge of Phosgene (CG) or Dioctyl Phthalate (DOP) until the concentration specified in the test plan is achieved.

NOTE: Chemical agent alarms and pigeons shall not be used during purge trials.

- b. Initiate sampling and operate the test item gas-particulate filter units.

- c. Determine the time required to purge the test item air-lock and shelter units of the contaminant.

- d. At the completion of the purge period:

- 1) Open and ventilate the test building.
- 2) Decontaminate the equipment according to the applicable pro-

cedures of paragraph 6.2.16.

- 3) Analyze and record the results from the sampling and detection devices.

#### 6.2.13 Biological Challenge Tests

##### 6.2.13.1 Preparation for Test

Perform the following:

- a. Select a building of suitable size in which to conduct the tests.
- b. Erect and pressurize the test item air-lock and shelter units.
- c. Install instrumentation as described in paragraph 6.1.5.
- d. Install the following at locations specified in the test plan:

- 1) Selected biological agent samplers
- 2) Biological agent alarms

- e. Determine and record the amounts and rates of dissemination of the selected biological agents required to produce the concentrations specified in the test plan, for each test.

NOTE: Liquid slurries of two non-pathogenic biological tracer materials (a spore former and vegetative form) may be used. The spore former can be Bacillus globigii (BG) and the vegetative form can be Serratia marcescens (SM).

- f. Select the dissemination method for each biological agent challenge.

NOTE: A collision atomizer, or similar apparatus, capable of disseminating small particle aerosols ( $\leq$  microns) shall be used.

- g. Ensure that test personnel have an adequate supply of protective clothing and equipment available.

##### 6.2.13.2 Test Conduct

###### 6.2.13.2.1 Control Sampling - Perform the following:

- a. Conduct a control sampling on a minimum of four test items being operated as described in paragraph 6.2.3 for the length of time specified in the test plan.
- b. Test personnel shall conduct a minimum of six entries and exits during the control sampling period.
- c. At the completion of the sampling period, analyze and record the results of the sampler assays to provide reference background data for the subsequent biological agent challenges to each test item.

###### 6.2.13.2.2 Aerosol Challenge - Perform the following:

a. Subject the test items used in paragraph 6.2.13.2.1 to a biological challenge of BG or SM, selected toxic agents and submicron particles, as required.

- NOTE:
1. The slurry concentrations and the biological disseminators used shall be adjusted to provide a challenge aerosol dosage of the prescribed number of spores, cells or particles per liter of air as prescribed in the test plan. Control samples of the slurries shall be taken prior to the trials and assayed.
  2. The meteorological limitations prescribed in the test plan shall be observed during the conduct of this procedure.

b. Initiate sampling and operate the test items in the contaminated atmosphere, as described in paragraph 6.2.3, for the length of time specified in the test plan.

c. Test personnel, wearing suitable protective clothing shall make a minimum of six entries and exits, to and from each test item, during the contaminant exposure period.

d. Record entry and exit operations on color motion picture film.

e. At the completion of the contaminant exposure period:

- 1) Open and ventilate the test building.
- 2) Open and ventilate the test items.
- 3) Decontaminate the equipment according to the applicable procedures of paragraph 6.2.16.
- 4) Analyze and record the results from the detection devices and the results of the sampler assays.

#### 6.2.13.2.3 Purge Trials - Perform the following:

a. Subject the interiors of a minimum of four test items to an aerosol challenge of BG in the spore concentration per liter of air and for the length of time specified in the test plan.

NOTE: Control samples of the BG slurry shall be taken prior to the trial and assayed.

b. At the termination of dissemination, initiate sampling and operate the test item gas-particulate filter units. Determine the time required to purge the test item air lock and shelter unit of the contaminant.

c. At the completion of the purge period:

- 1) Open and ventilate the test building.
- 2) Decontaminate the equipment according to the applicable procedures of paragraph 6.2.16.

NOTE: Betapropiolactone (BPL) or some other non-residual decontaminant shall be used.

3) Air samples taken shall be sent to the laboratory for assay.

6.2.14 Emergency Adaptability

a. Erect and pressurize a minimum of four test item air-locks and shelter units.

b. Using small arms fire, puncture each of the test item air-lock and shelter unit liners as directed by the test plan and record:

- 1) Number of punctures
- 2) Caliber of weapons used for punctures

c. Tape the puncture holes from the inside.

d. Install instrumentation as described in paragraph 6.1.5.

e. Operate the test items as described in paragraph 6.2.3.

f. Remove the tape from a number of punctures in each test item as specified by the test plan.

g. Determine and record the following for each test item:

- 1) Number of punctures uncovered
- 2) Interior pressure change
- 3) Time duration until pressure stabilization

h. Repeat steps f and g until all of the punctures have been uncovered.

i. Record the time required, after the pressure has changed, until the low pressure warning alarms are activated and record the pressure differential at which the actuation occurs.

j. Determine whether personnel in the test items have time to don protective masks in the event of contamination due to the punctures.

6.2.15 Alarm Tests

Determine the operational capabilities of the chemical and biological alarm systems (if a part of the protective shelter system) according to the applicable procedures of MTP 8-2-066 and MTP 8-2-191.

6.2.16 Decontamination Aspects

a. Test items, which become contaminated and require decontamination, shall be decontaminated as directed in the applicable sections of MTP 8-2-510.

b. Verify the operability of the test item after decontamination by subjecting it to the procedures of paragraph 6.2.3.

c. Buildings or grounds which become contaminated during the conduct of this MTP shall be decontaminated using the appropriate methods.

d. Determine and record any deleterious effects of decontamination on test item liner materials and test item components.

6.2.17 Gas Life Test

a. Determine the chemical protective life of the gas filter(s) using the method prescribed by MIL-STD-282, Method 101.1.2.

b. Determine and record the concentration of CG:

- 1) By chemical analysis
- 2) By gravimetric analysis

c. Measure and record the air resistance of the filter.

6.2.18 Special "Gas" Tests

6.2.18.1 Dioctyl Phthalate (DOP) Test

a. The efficiency of the particulate filter(s) shall be determined using the method prescribed by MIL-STD-282, Method 102.9.1.

b. The percent of DOP that penetrated the filter(s) and the air resistance of the filter shall be determined.

c. The length of time each filter was exposed to DOP, and any irregularities encountered during the test shall be observed and recorded.

6.2.18.2 Chloropicrin (PS) Test

a. Subject the system, while in operation, to chloropicrin (PS) in a concentration, and for the length of time, specified in the test plan.

b. Take bubbler samples.

c. Analyze the samples taken according to "Chemical Medical Laboratories Research Report No. 62, Micro Determination of Chloropicrin", or other comparable procedure.

6.2.19 Maintenance Aspects

a. Determine the test item maintenance aspects in accordance with AMC Pamphlet 706-134.

NOTE: The features of design which permit or enhance the accomplishment of maintenance by personnel of average skill under environmental conditions, similar to those in which maintenance is to be performed, shall be recorded.

b. Determine and record the following, as required:

- 1) Ease of maintenance performed
- 2) Component interchangeability
- 3) Adequacy and accuracy of the maintenance documentation
- 4) Maintenance category of the test item
- 5) Mean-time-to-repair test items
- 6) Special tools and ancillary equipment required
- 7) Recommendations pertaining to improvements that could be made
- 8) Maintenance-free hours of continuous service
- 9) Time required to perform maintenance tasks
- 10) Time required to detect and diagnose failures
- 11) Causes of malfunctions such as quality of workmanship, wear,

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inadequate design tolerances, lack of operation, etc.

6.2.20 Human Factors

Throughout the conduct of this MTP, observations shall be made relative to the human factors engineering characteristics of the test item. Specific areas of observation shall include the following:

- a. Ease of handling, erecting and preparing the test item for operation.
- b. Adequacy of instructional material.
- c. Compatibility of the test item with field clothing and equipment (i.e., ease of operations when wearing protective clothing and equipment.)
- d. Factors which caused frequent complaints from test personnel.

6.3 TEST DATA

6.3.1 Receipt Inspection

- a. Record the following:
  - 1) Receipt inspection data collected as described in the applicable sections of MTP 8-2-500.
  - 2) Adequacy of packaging:
    - a) Binding deficiencies
    - b) Packaging material deficiencies
  - 3) Damage to test item, including:
    - a) Dents
    - b) Cracks
    - c) Illegible markings
  - 4) Dimensions of major components, packaged and unpackaged:
    - a) Length, width, and height in inches
    - b) Weight, in pounds
- b. Retain all photographs.

6.3.2 Safety Evaluation

Record the following:

- a. Any hazardous characteristics.
- b. Any deficiencies and/or recommended conclusions pertaining to the Safety Statement.
- c. Acoustical noise level data collected as described in HEL-STD-S-1-63B.

6.3.3 Performance Test

Record the following for each test item, continuously during operation:

- a. Temperatures, in degrees F, as follows:
  - 1) Shelter unit, ambient interior
  - 2) Air-lock, ambient interior
  - 3) Ambient exterior
- b. Pressures, as follows:
  - 1) Shelter unit interior, in psi
  - 2) Air-lock interior, in psi
  - 3) Ambient exterior pressure, in inches of Hg
- c. Input voltages to the following:
  - 1) Gas particulate filter unit
  - 2) Environmental control system
- d. Input currents to the following:
  - 1) Gas-particulate filter unit
  - 2) Environmental control system
- e. Air-flow rates of the gas-particulate filter unit, in cfm
- f. Duration of test item operation, in minutes
- g. Relative humidity of the shelter unit interior
- h. Malfunction (if any)
- i. Cause(s) of malfunctions

6.3.4 Flammability Test

Record the following:

- a. Data for shelter and air-lock liners as required by ASTM D-1230-61
- b. Test material nomenclature

6.3.5 Physical Strength Test

Record the following for each test conducted:

- a. Data for shelter and air-lock liners as required by ASTM D-751-66T
- b. Test material nomenclature
- c. Test identity
- d. Test specimen sizes (if "non-standard")
- e. Test sample preparations for die-cut samples used in tear-resis-

tance tests

6.3.6 Agent Penetration Tests



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a. Record agent resistance data for the shelter liner and air-lock cover material as required by the agent penetration test used.

b. Record the following for each specimen:

- 1) Test material nomenclature
- 2) Chemical agent used (GF, VX, HD)
- 3) Test specimen dimensions, in inches
- 4) Ambient room temperature during the test, in degrees F
- 5) Relative humidity of the test room during the test
- 6) Test method used

#### 6.3.7 Simulated Environmental Tests

##### 6.3.7.1 Extreme Temperature Tests

###### 6.3.7.1.1 Low Temperature Tests -

Record the following for each test item, as applicable:

a. Test item identification number

b. For temperature of -80°F:

- 1) Damages incurred

c. For temperature of -65°F:

- 1) Damages incurred
- 2) Operability data, collected as described in paragraph 6.2.3

d. For ambient temperature:

- 1) Temperature, in degrees F
- 2) Test item damage
- 3) Operability data collected as described in paragraph 6.3.3
- 4) Damage incurred due to testing
- 5) Component damage (disassembled items only)

###### 6.3.7.1.2 High Temperature Tests -

Record the following:

a. Test item identification number

b. Operability data, collected as described in paragraph 6.2.3

c. For temperature of 155°F:

- 1) Damages incurred

d. For temperature of 120°F:

- 1) Damages incurred

2) Operability data, collected as described in paragraph 6.2.3

e. For ambient temperature:

- 1) Temperature, in degrees F
- 2) Damages incurred
- 3) Operability data, collected as described in paragraph 6.2.3

#### 6.3.7.2 Fungus Test

Record the following for each test item, as applicable:

- Method 508
- a. Test item identification number
  - b. Data as collected under the applicable sections of MIL-STD-810,
  - c. Evidence of fungus growth on:
    - 1) Test item
    - 2) Components (disassembled items only)
  - d. Operability data as collected under the applicable sections of paragraph 6.2.3

#### 6.3.7.3 Humidity Test

Record the following for each test item, as applicable:

- Method 507
- a. Test item identification number
  - b. Data as collected under the applicable sections of MIL-STD-810,
  - c. Evidence of corrosion on:
    - 1) Test item
    - 2) Components (disassembled items only)
  - d. Operability data as collected under the applicable sections of paragraph 6.2.3

#### 6.3.7.4 Sunshine Test

Record the following for each test item, as applicable:

- Method 505
- a. Test item identification number
  - b. Data as collected under the applicable sections of MIL-STD-810,
  - c. Evidence of deterioration of:
    - 1) Test item
    - 2) Components (disassembled items only)
  - d. Operability data as collected under the applicable sections of

paragraph 6.2.3

6.3.7.5 Salt Fog Test

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Evidence of corrosion on:
  - 1) Test item
  - 2) Test item components (disassembled items only)
- c. Evidence of water penetration
- d. Operability data, collected as described in paragraph 6.2.3

6.3.7.6 Altitude Tests

Record the following for each test item, as applicable:

- a. Test item identification number
- b. Data as collected under the applicable sections of MIL-STD-810,  
Method 500
- c. Evidence of deterioration of:

- 1) Test item
- 2) Components (disassembled items only)

- d. Operability data as collected under the applicable sections of  
paragraph 6.2.3

6.3.7.7 Water Immersion Tests

Record the following for each test item, as applicable:

- a. Test item identification number
- b. During immersion:
  - 1) Depth of water over container, in inches
  - 2) Water temperature, in degrees F
  - 3) Presence of bubbling, if any
  - 4) Immersion time to bubbling, if any, in minutes
  - 5) Total immersion time, in minutes
- c. For the test item:
  - 1) Presence of corrosion on:
    - a) Test item
    - b) Test item components (disassembled items only)
  - 2) Presence of water penetration

3) Operability data, collected as described in paragraph 6.2.3

6.3.7.8 Rain Tests

Record the following for each test item:

- a. Test item identification number
- b. Evidence of water penetration of the test item:
  - 1) Visually
  - 2) By ultraviolet light (to show fluorescence)

c. Evidence of water penetration of the following (visually and by ultraviolet light):

- 1) Gas filter(s)
  - 2) Particulate filter(s)
  - 3) Unit housing
  - 4) Dust collector
  - 5) Motor section
- d. Damage to test item components
- e. Filter efficiency data collected as described in paragraph 6.2.18
- f. Filter positions (sheltered, unsheltered)
- g. Operability data, collected as described in paragraph 6.2.3

6.3.7.9 Snow Tests

Record the following for each test item:

- a. Test item identification number
- b. Pressure of the snow, in psi, on:
  - 1) Air-lock
  - 2) Shelter
- c. Depth of the snow, in inches, on:
  - 1) Air-lock
  - 2) Shelter
- d. Evidence of damage to:
  - 1) Shelter
  - 2) Air-lock
  - 3) Components
- e. Operability data, collected as described in paragraph 6.2.3
- f. Filter efficiency data collected as described in paragraph 6.2.18

g. Retain all photographs

6.3.7.10 Dust Removal Tests

a. Record the following for each test item:

- 1) Test item identification number
- 2) Data as required by the applicable sections of MIL-STD-810, Method 510.
- 3) Weight of the gas filter(s), in grams:
  - a) Prior to dust operations
  - b) Upon completion of dust operations
- 4) Weight of the particulate filter(s), in grams:
  - a) Prior to dust operations
  - b) Upon completion of dust operations
- 5) Time (from start of dust operations) at which the particulate filter warning light was energized, in minutes
- 6) Evidence of damage to the dust collector
- 7) Operability data, collected as described in paragraph 6.2.3

b. Retain all photographs

6.3.8 Field Tests

6.3.8.1 Wind Challenge Tests

a. Record the following for each test item during erection operations:

- 1) Test item identification number
- 2) Time required for erection of the test item, in minutes
- 3) Difficulties encountered during erection operations

b. Record the following for each test item during striking operations:

- 1) Test item identification number
- 2) Time required for striking of the test item, in minutes
- 3) Difficulties encountered during striking operations

c. Record the following for each test item during each wind challenge operation:

- 1) Test item identification number
- 2) Maximum wind velocity, in mph
- 3) Wind direction with respect to the test item
- 4) Number of entries made
- 5) Number of exits made
- 6) Deleterious effects on test item operation

- 7) Duration of wind challenge, in minutes
- 8) Operability data, collected as described in paragraph 6.2.3

- d. Record any evidence of damage to each test item.
- e. Retain all photographs and motion picture film.

#### 6.3.8.2 Fog-Oil Smoke Tests

Record the following for each test item:

- a. Test item identification number
- b. Fog-oil smoke density, in particles per liter of air
- c. Wind direction
- d. Wind speed, in mph
- e. Operability data, collected as described in paragraph 6.2.3
- f. Deleterious effects on the operability of the test item
- g. Duration of fog-oil smoke challenge, in minutes
- h. Evidence of damage to test item components

#### 6.3.9 Rough Handling and Surface Transportability

- a. Record the following, as applicable:

- 1) Test performed (shock, vibration)
- 2) Test item identification number
- 3) For test item container:
  - a) Presence of cracks, breaks, etc.
  - b) Undone bindings
- 4) Evidence of damage to test item
- 5) Operability data, collected as described in paragraph 6.2.3

- b. Retain all photographs

#### 6.3.10 Air Transportability

##### 6.3.10.1 Loading/Unloading

Record the following:

- a. Type of aircraft used/simulated
- b. Shipping container:
  - 1) Length, width and height, in inches
  - 2) Weight, in pounds
  - 3) Material (steel, aluminum, metal/reinforced plastic, etc.)
- c. Equipment used in loading
- d. Method of container tie-down
- e. Damage to test item incurred during loading
- f. Difficulties encountered while loading
- g. Equipment used in unloading

h. Difficulties encountered while unloading

6.3.10.2 Simulated Flight Test

a. Record the following for each test item, as applicable:

- 1) Test item identification number.
- 2) Altitude simulated, in feet.
- 3) Ambient pressure in test chamber, in inches of Hg.
- 4) Data as collected under the applicable sections of MIL-STD-810, Method 514.
- 5) For test item shipping container:
  - a) Presence of cracks, breaks, etc.
  - b) Undone bindings
- 6) Evidence of damage to test item.
- 7) Operability data, collected as described in paragraph 6.2.3.

b. Retain all photographs

6.3.11 Air Drop Capability

a. Record the following for each test item:

- 1) Condition of test item (how packaged and crated)
- 2) Test item identification number
- 3) Aircraft used
- 4) Aircraft altitude, in feet (at release)
- 5) Aircraft airspeed, in mph (at release)
- 6) Air conditions (calm, turbulent)
- 7) Air delivery system trajectory
- 8) Test item impact velocity, in fps
- 9) Acceleration force at impact, in "G's"
- 10) For test item package:
  - a) Packaging material used
  - b) Presence of cracks, breaks, etc.
  - c) Undone bindings
- 11) For the test item:
  - a) Damage or deformation
  - b) Operability data, collected as described in paragraph 6.2.3

b. Retain all photographs and motion picture film.

6.3.12 Chemical Challenge Tests

6.3.12.1 Preparation for Test

Record the following for each test item:

- a. Locations of chemical agent samplers.
- b. Locations of chemical agent alarms (for non-entry-exit challenge).
- c. Locations of pigeons (for non-entry-exit challenge).
- d. Number of chemical agent samplers.
- e. Number of chemical agent alarms.
- f. Number of pigeons.
- g. Amount of chemical agent to be disseminated for each test agent selected, in grams.
- h. Rate of chemical agent dissemination for each test agent selected, in grams per minute.
- i. Dissemination method for each chemical agent to be used.
- j. Instrumentation locations.

6.3.12.2 Test Conduct

6.3.12.2.1 Non-Entry-Exit Challenge -

Record the following for each test item:

- a. Test item identification number
- b. Chemical agent identity
- c. Agent concentration level per liter of air
- d. Duration of chemical agent challenge, in minutes
- e. Operability data, collected as described in paragraph 6.2.3
- f. Upon completion of the challenge:
  - 1) Chemical agent alarm status
  - 2) Sampling device analysis results
  - 3) Pigeon examination results
  - 4) Decontamination data, collected as described in paragraph 6.2.16

6.3.12.2.2 Entry-Exit Challenge -

a. Record the following for each test item:

- 1) Test item identification number
- 2) Chemical agent identity
- 3) Agent concentration level per liter of air
- 4) Duration of the chemical agent challenge, in minutes
- 5) Number of entries made
- 6) Number of exits made
- 7) Operability data, collected as described in paragraph 6.2.3
- 8) Sampling device analysis results
- 9) Decontamination data, collected as described in paragraph 6.2.16

b. Retain all photographs and motion picture film

6.3.12.2.3 Purge Trials -



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Record the following for each test item:

- a. Test item identification number
- b. Chemical agent identity
- c. Agent concentration level per liter of air:
  - 1) Within the shelter unit
  - 2) Within the air-lock
- d. Time required, in minutes, to purge:
  - 1) Shelter unit
  - 2) Air-lock
- e. Operability data collected as described in paragraph 6.2.3
- f. Upon completion of the purging operations:
  - 1) Sampling device analysis results
  - 2) Decontamination data, collected as described in paragraph 6.2.16

#### 6.3.13 Biological Challenge Tests

##### 6.3.13.1 Preparation For Test

Record the following for each test item:

- a. Locations of biological agent samplers
- b. Locations of biological agent alarms
- c. Number of biological agent samplers
- d. Number of biological agent alarms
- e. Amount of biological agent to be disseminated for each test agent selected, in grams
- f. Rate of biological agent dissemination for each test agent selected, in grams per minute
- g. Dissemination method for each biological agent to be used
- h. Instrumentation locations

##### 6.3.13.2 Test Conduct

###### 6.3.13.2.1 Control Sampling -

Record the following for each test item:

- a. Test item identification number
- b. Number of entries made
- c. Number of exits made
- d. Operability data, collected as described in paragraph 6.2.3
- e. Results of air sampler assays

###### 6.3.13.2.2 Aerosol Challenge -

a. Record the following for each test item:

- 1) Test item identification number
- 2) Biological agent identity
- 3) Agent concentration, in particles per liter of air
- 4) Duration of the biological agent challenge, in minutes
- 5) Number of entries made
- 6) Number of exits made
- 7) Operability data, collected as described in paragraph 6.2.3
- 8) Results of air sampler assays
- 9) Results of slurry sample assays
- 10) Decontamination data, collected as described in paragraph 6.2.16

b. Retain all photographs and motion picture film.

6.3.13.2.3 Purge Trials -

Record the following for each test item:

- a. Test item identification number
- b. Biological agent identity
- c. Agent concentration, in particles per liter of air:
  - 1) Within the shelter unit
  - 2) Within the air-lock
- d. Time required, in minutes, to purge:
  - 1) Shelter unit
  - 2) Air-lock
- e. Operability data, collected as described in paragraph 6.2.3
- f. Upon completion of the purging operations:
  - 1) Results of air sampler assays
  - 2) Decontamination data, collected as described in paragraph 6.2.16

6.3.14 Emergency Adaptability

a. Record the following for each test item:

- 1) Test item identification number
- 2) Number of punctures in:
  - a) Shelter unit liner
  - b) Air-lock liner
- 3) Caliber of weapons used for punctures

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- 4) Operability data, collected as described in paragraph 6.2.3
- b. Record the following for each test item for each tape removal phase:
- 1) Test item identification number
  - 2) Number of punctures uncovered
  - 3) Internal pressure change, in psi:
  - 4) Time duration until pressure stabilization
  - 5) Operability data, collected as described in paragraph 6.2.3
- c. Record the time required, after the pressure has changed, until the low pressure warning alarms are actuated and the pressure differential, in psi, at which actuation occurs.
- d. Record comments on the adequacy of time for personnel to don protective masks in the event of contamination due to punctures.

6.3.15 Alarm Tests

Record chemical and biological alarm data (if alarms are a part of the protective shelter system) collected as described in the applicable sections of MTP 8-2-066 and MTP 8-2-191.

6.3.16 Decontamination Aspects

Record the following for each test item:

- a. Data as collected under the applicable sections of MTP 8-2-510
- b. Operability data, collected as described in paragraph 6.2.3
- c. Deleterious effects of decontamination on the test item liner materials and test item components.

6.3.17 Gas Life Test

Record the following for each test item:

- a. Test item identification number
- b. Data, collected as described in MIL-STD-282, Method 101.2
- c. Concentration of CG in each filter:
  - 1) By chemical analysis
  - 2) By gravimetric analysis
- d. Filter air resistance:
  - 1) At the beginning of the test
  - 2) At the completion of the test

6.3.18 Special "Gas" Tests

Record the following for each test item:

- a. Test item identification number
- b. Type of gas agent (DOP, PS)
- c. Agent concentration level per liter of air
- d. Duration of contaminant exposure, in minutes
- e. Irregularities encountered during the test
- f. Results of sample analysis

6.3.19 Maintenance Aspects

- a. Record the following:
  - 1) Ease of maintenance performed
  - 2) Component interchangeability
  - 3) Adequacy and accuracy of the maintenance documentation
  - 4) Maintenance category of the test item
  - 5) Mean-time-to-repair test item
  - 6) Special tools and ancillary equipment required
  - 7) Recommendations pertaining to improvements that could be made
  - 8) Maintenance-free hours of continuous service
  - 9) Time required to perform maintenance tasks, in hours
  - 10) Time required to detect and diagnose failure, in minutes
  - 11) Causes of malfunctions

6.3.20 Human Factors

Record comments on the following:

- a. Ease of handling, erecting and preparing the test item for operation
- b. Adequacy of instruction material for the test item
- c. Compatibility of the test item with field clothing and equipment (i.e., ease of operations when wearing protective clothing and equipment)
- d. Factors which caused frequent complaints from test personnel

6.4 DATA REDUCTION AND PRESENTATION

6.4.1 Receipt Inspection

- a. Data collected as a result of this procedure shall be presented as indicated in applicable portions of MTP 8-2-500.
- b. The description of the item, number of items tested, and conditions upon receipt shall be presented in tabular form.

6.4.2 Safety Evaluation

- a. A Safety Release Recommendation (USATECOM Regulation 385-6) shall be forwarded to U. S. Army Test and Evaluation Command within 30 days of the beginning of the test.
- b. The Safety Release Recommendation shall contain the following:
  - 1) Special safety considerations on hazards to personnel and

materiel (including developmental types of equipment, as well as standard components used in assemblage of items being tested).

- 2) Data and comments relative to safety hazards observed during any phase of testing
- 3) Comments relative to suggested safety improvements
- 4) Results of the acoustical noise level determination shall be presented in suitable form.

#### 6.4.3 Performance Test

The results from this subtest, conducted in conjunction with other subtests, as specified, shall be presented in tabular form and shall, through comparison and analysis, provide the basis for determining the operational characteristics and operational reliability of the test item.

#### 6.4.4 Flammability Test

Present comparison data, from testing, in accordance with ASTM D-1230-61, in order to evaluate the flame resistance of the shelter liner material.

#### 6.4.5 Physical Strength Tests

Present data from the various physical tests in accordance with ASTM D-751-66T, in order to evaluate the physical characteristics of the shelter liner material.

#### 6.4.6 Agent Penetration Tests

The data from these tests shall be tabulated and presented to evaluate the degree of protection afforded by the shelter liner material.

#### 6.4.7 Simulated Environmental Testing

- a. The results of the subtests conducted shall be presented in tabular or other suitable form.
- b. The results of the operability tests performed at the conclusion of the various environmental tests shall be presented in narrative or other suitable form to provide comparative results.
- c. Photographs and motion pictures shall be used as required to substantiate conclusions.

#### 6.4.8 Field Tests

The results of the subtests shall be presented in suitable form supplemented by the motion pictures taken during the wind operations.

#### 6.4.9 Rough Handling and Surface Transport

- a. The results of this subtest shall be presented as indicated in applicable portions of MTP 8-2-503.

b. Tables, photographs, narrative comments or other suitable means of presentation shall be used to report the results.

6.4.10 Air Transportability

a. The results of this subtest shall be presented as prescribed in MTP 7-1-002.

b. Air transport conditions shall be reported in tabular or other convenient form.

c. Narrative comments, photographs, etc., shall be included, as required.

6.4.12 Chemical Challenge Tests

Present the following:

a. Data in tabular and photographic form to indicate the results of the various challenges

b. Comparative data to show test item susceptibility to various agents or conditions

c. Drawings, charts, and other illustrative material to substantiate the conclusions

6.4.13 Biological Challenge Tests

Present the following:

a. Data in tabular and photographic form to indicate the results of the various challenges

b. Comparative data (based on the control sampling) to show test item susceptibility to various agents or conditions

c. Drawings, charts, and other illustrative material to substantiate the conclusions

6.4.14 Emergency Adaptability

Present results in tabular form to show the degree to which the test item can be damaged and still afford the required protection against toxic agents.

6.4.15 Alarm Tests

Present results as required by the applicable sections of MTP 8-2-066 and MTP 8-2-191.

6.4.16 Decontamination Aspects

The results of this subtest shall be presented as indicated in the applicable sections of MTP 8-2-510.

6.4.17 Gas Life Test

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Data obtained as a result of this subtest shall be reduced and analyzed, as required. Results shall be presented in the prescribed form using tables, charts, graph, pictures, and narrative comments, as applicable.

6.4.18 Special "Gas" Tests

Data from this subtest shall be presented in narrative form supplemented by other required forms of presentation necessary to substantiate the conclusions.

6.4.19 Maintenance Aspects

Data from this subtest shall be presented in narrative form, showing what maintenance was required to repair the test item. The report shall be supplemented by photographs, drawings, or other devices to substantiate the conclusion and recommendations.

6.4.20 Human Factors

a. Data collected as a result of considering the human factors aspects of the test item shall, if possible, be submitted to a qualified human engineering analyst for evaluation.

b. Data shall be presented in narrative form, supplemented by drawings, photographs and recommendations relative to improving the human engineering aspects of the test item.

## APPENDIX A

### TEST METHOD FOR AGENT PENETRATION

#### 1. Test Apparatus

The apparatus consists of a flanged bottom cup and a shallow top cup between which a sample of the test fabric can be placed and contaminated with agent. The cups are constructed so that air, at approximately 1/2 mph (44 ft/min), is pulled across the contaminated fabric and the agent vapor which penetrates the fabric is swept out of the bottom cup at a low flow rate. One liter of air per minute is pulled through the bottom cup and into an absorbent bubbler.

#### 2. Test Procedure

The fabric sample is sealed between the top and bottom cups with wax or clamps. The outlet is connected to a standard vapor bubbler containing an appropriate solvent. The apparatus is placed in a hood at room temperature. The lid on the top cup is removed and four 0.5 mg drops of agent are dropped by means of an air-aided dropping apparatus onto the test fabric. The lid is immediately replaced and bubbler sampling started. The bubbler sampler shall be analyzed, enzymatically, after six hours of testing. The analysis of the contents of the bubbler is used to determine the degree of protection afforded by the test fabric.